Volunteer Monitoring Report
Summary for Little Washougal River in the Washougal River Watershed
Clark County Washington

Introduction

This document provides a summary of volunteer monitoring activities on the Little Washougal River in the Washougal River watershed. Monitoring took place over an approximate two-year period and was done entirely by volunteers with supervision by the Clark County Water Resource's program staff. The station became inactive after the fall monitoring in October 2004. This summary is intended to provide volunteers and the public with a summary of the results of the Little Washougal River monitoring.

Results of Monitoring the Little Washougal River

Watershed Condition

The Little Washougal River drains the lower and upper Little Washougal River subwatersheds, which are part of the Washougal River watershed in Clark and Skamania Counties, Washington (Figure 1). The upper portion of the basin includes Boulder and Jones Creeks, and the East Fork of the Little Washougal River. The drainages are part of a group of watersheds in Clark County that include small streams coursing through a moderately steep landscape, overlying predominantly rocky ground. Local creeks with similar characteristics include Cedar and Yacolt Creeks in the East Fork Lewis watershed. Table 1 below summarizes the primary natural characteristics of the upper basin.

Table 1. Primary natural subwatershed characteristics for Upper Little Washougal River watershed.

Characteristic	***Value***	***Characteristic***	***Value***
Drainage Area	14.3 square miles	Topography	Average watershed surface slope of 20%, moderately steep terrain category
Stream Size	Mid-sized streams of 3rd and 4th order	Average Elevation	1700 ft
Soils/Geology	Predominantly well drained soils over bedrock; mostly cobble (tennis ball to basketball) and boulder sized substrate.	Average Precipitation	105 inches annually

The lower portion of the basin includes mainly the Little Washougal River and many small headwater tributaries connecting directly to it. The drainage is part of a group of watersheds in Clark County that include large streams coursing through a moderately steep landscape, overlying predominantly rocky ground. Local rivers with similar characteristics include Rock Creek (South) and the upper main stem of the East Fork Lewis watershed. Table 2 below summarizes the primary natural characteristics of the lower basin.

Table 2. Primary natural subwatershed characteristics for Lower Little Washougal River watershed.

Characteristic	***Value***	***Characteristic***	***Value***
Drainage Area	10.2 square miles	Topography	Average watershed surface slope of 15%; moderately steep terrain category
Stream Size	Large stream	Average Elevation	550 ft
Soils/Geology	Predominantly well drained soils over bedrock and some gravel; mostly large gravel (marble to tennis ball) and cobble (tennis ball to basketball) sized substrate; some boulder sized substrate.	Average Precipitation	66 inches annually

The level of watershed development has an important effect on stream characteristics and quality. Commercial timber production results in a mix of conditions ranging from mature evergreen stands to bare earth stripped of vegetation. Rural development typically includes the conversion of forest cover to agricultural or residential uses and the construction of road networks. Table 3 summarizes the primary development intensity characteristics of both the upper and lower subwatersheds.

Overall, the watershed has a mix of development characteristics. The upper watershed is used primarily for timber production, recreation, and municipal water supply. Much of the land in the upper watershed is publicly owned or retained privately in large parcels by timber companies. The lower watershed supports primarily rural residential and agricultural uses. Much of the forest cover has been cleared in the lower watershed. Road density and percentage of total impervious area (TIA) indicate a higher level of urban development along with potential impacts from agriculture operations. TIA refers to the amount of land covered by non-absorbing surfaces such as roads, parking lots, houses, and compacted soil.

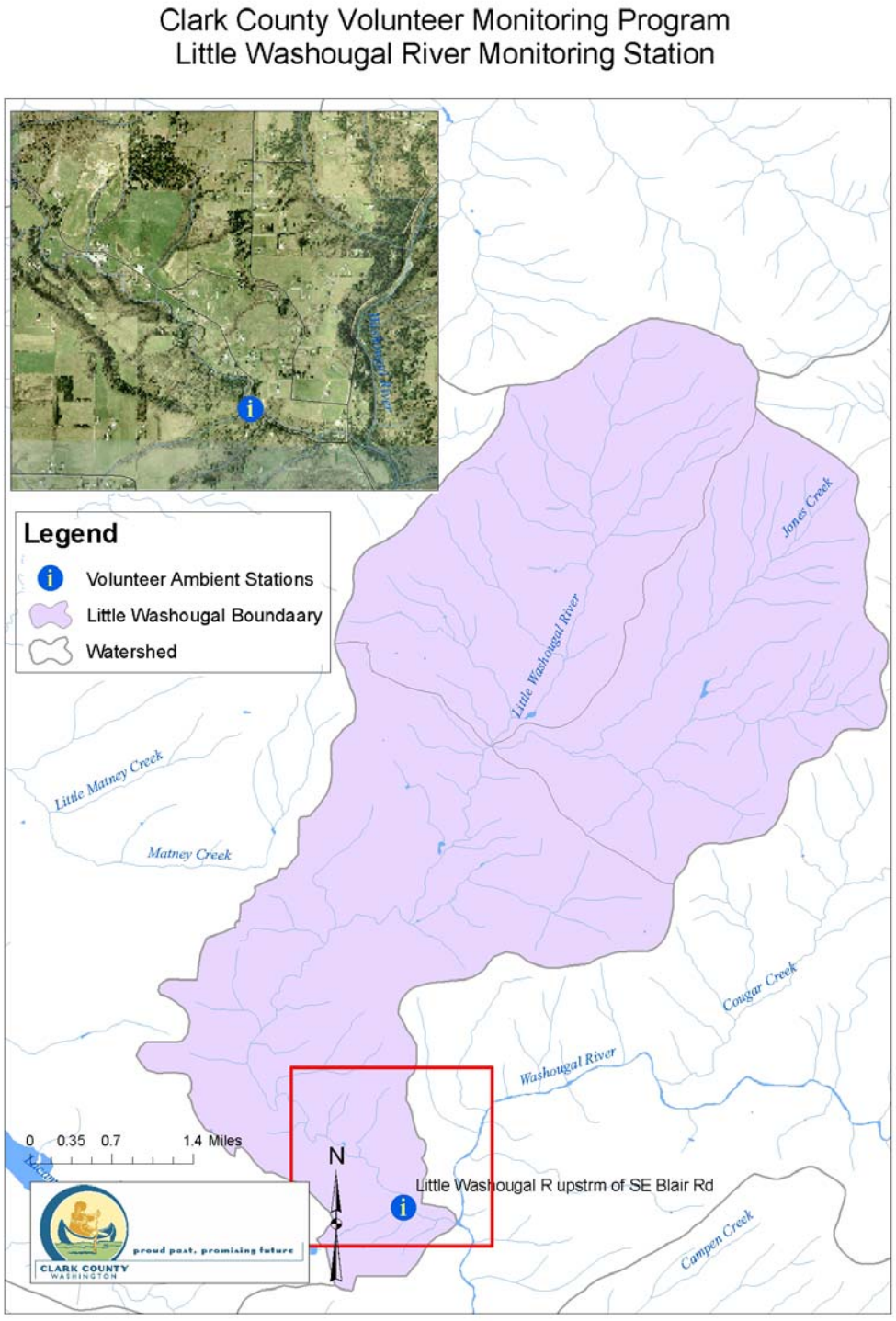

Figure 1. Map of the Little Washougal River subwatersheds and detail map of the monitoring station.

Table 3. Subwatershed characteristics of land development intensity for the Upper and Lower Little Washougal River watersheds.

Characteristic	Value	Desired Condition for Stream Health
Road Density	2.7 miles per square mile in Upper 5.7 miles per square mile in Lower	< 3 miles per square mile (NOAA Fisheries 2003)
Total Impervious Area (TIA)	~6-7% impervious surfaces	<15% (NOAA Fisheries 2003)
Median Parcel Size	~ 5-6 acres	No threshold but <5 acres storm water planning is recommended; county median subwatershed parcel size is about 3.5 acres.
Population Density	<50 people per square mile in Upper; ~100 people per square mile in Lower	No threshold; county median subwatershed population density is 220 people per square mile
Land Use	Primarily zoned forest/open space, rural residential and agriculture ~60-70% land publicly owned in Upper; ~10% land publicly owned in Lower;	No threshold; land use indicates storm water runoff rates and potential pollution sources No threshold; public land provides opportunity for restoration.
Land Cover	~85% forest cover in Upper; ~48% forest cover in Lower, ~31% natural grassy areas and crops in Lower;	> 50% forest cover (NOAA Fisheries 2003) No threshold.

Monitoring Activity Summary

The Little Washougal River site was monitored by the Coho team from October 2002 to October 2004. Volunteers visited the site nine times in that period. Each time water samples were collected and submitted to a local laboratory. Three macroinvertebrate samples for biological assessment were collected over the same period. In addition, volunteers performed two habitat surveys. Water temperature was continuously recorded by a county-operated permanent flow monitoring station located just downstream of the volunteer site.

Water Quality Results

Clark County staff use a water quality index that was developed by the Oregon Department of Environmental Quality for communicating and tracking volunteer collected data (http://www.deq.state.or.us/lab/wqm/wqimain.htm). The Oregon Water Quality Index (OWQI) analyzes a defined set of water quality parameters and produces a score describing general water quality. OWQI scores range from 10 (worst case) to 100 (ideal water quality).

A water quality index is a single number which expresses water quality by integrating multiple measurements of water quality parameters. This index provides a simple, concise, and valid

method for expressing the significance of regularly collected data, and was designed to aid in the assessment of water quality for general recreational uses.

As with most methods for generalizing water quality data, there are limitations to the interpretation of the data. The index cannot determine the quality of water for all uses. Some uses conflict with others. For instance, water quality considerations for agricultural uses are different from considerations for recreational uses. The index cannot provide complete information on water quality. An index provides only a summary of the data.

The OWQI can be used to show water quality variation both spatially and temporally. The index allows users to easily interpret data and relate overall water quality variation to variations in specific categories of impairment. The OWQI can identify water quality trends and problem areas. These can be screened out and evaluated in greater detail by direct observation of pertinent data, thus increasing efficiency. Used in this manner, the OWQI provides a basis to evaluate effectiveness of water quality improvement programs and assist in establishing priorities for management purposes.

The figures below summarize the water quality index scores for the individual parameters, as well as for the monthly values during the entire monitoring period. A couple general patterns emerge from the Little Washougal River dataset (Figures 3 and 4). Water quality index scores were typically lower during the summer relative to other times of the year. Specifically fecal coliform and water temperature scores were lower during the summer sampling period. Nitrate was of concern during the wetter months with scores in the fair category. Total phosphorus levels were generally low but a single observation in 2004 raises some concern, although it does not appear to be a chronic problem. It is important to remember that many water quality problems, such as high fecal coliform and total phosphorus levels, get worse during storms and that this project did not target storms for monitoring.

The overall score shown in Figure 4 put the site in the 'Good Condition' category, a few points from the 'Excellent' category.

An assessment of water temperature is possible using the continuous datasets from 2003 and 2004. A county stream flow gauge at Blair Road recorded hourly water temperature readings during the warmest period of the year, typically from May to October. A Washington State stream temperature criterion sets a maximum temperature of 64^{o}F to protect sensitive aquatic life like salmon and trout. Water temperature under the current state criterion is measured by the 7-day average of the daily maximum temperature (7-DADMax). The 7-DADMax is the average of daily maximums based on a moving seven-day window. So, for any given seven days there is one averaged maximum temperature. Scientists can use this to determine how often water temperature exceeded the standard, and get an average for the month or season.

The 7-DADMax water temperature for the summer season was just above 73ºF during both 2003 and 2004. The water temperature in the stream exceeded the state standard for over 80 days in 2003, nearly three months, however that number dropped to just over 50 days in 2004. During both years water flow was very low in the summer, which would contribute to the problem of high water temperature.

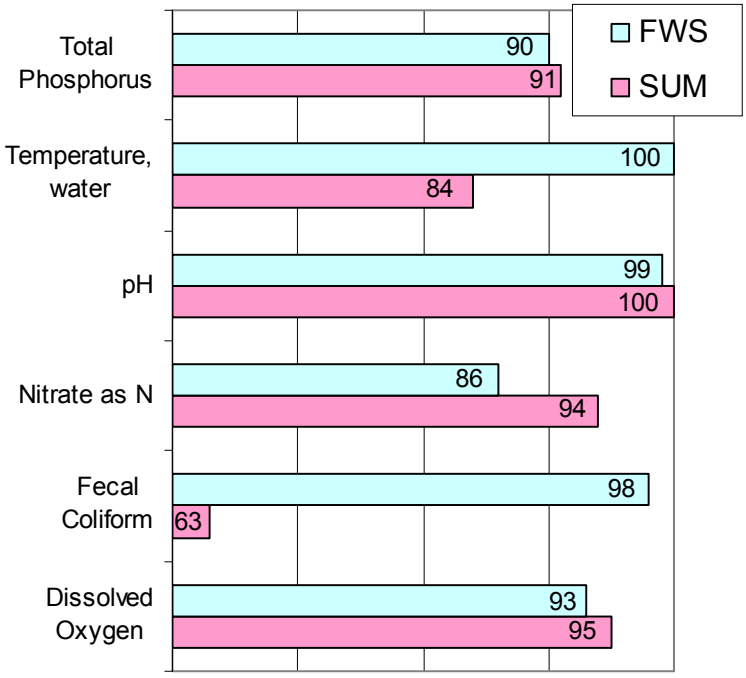

Figure 3. Average water quality index scores by parameter for the Little Washougal River from Oct 2002-Oct 2004. FWS and SUM represent the 'Fall/Winter/Spring' and 'Summer' monitoring periods, respectively; the Oregon WQI scoring system is as follows: < 60 = Very Poor Condition; 60-79 = Poor Condition; 80-84 = Fair Condition; 85-90 = Good Condition; > 90 = Excellent Condition.

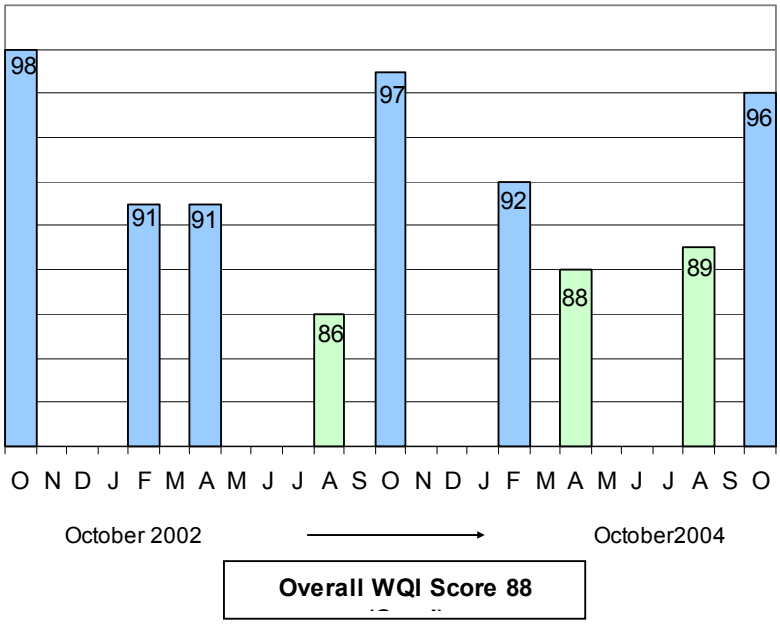

Figure 4. Monthly water quality index scores based on parameters shown in Figure 1; the Oregon WQI Scoring system is as follows: < 60 = Very Poor Condition; 60-79 = Poor Condition; 80-84 = Fair Condition; 85-90 = Good Condition; > 90 = Excellent Condition.

Biological Health as Indicated by Macroinvertebrates

Aquatic macroinvertebrates are good indicators of water quality and mirror changes in water quality with changes in their populations. Scientists have studied aquatic bugs for several decades and have developed indices to characterize stream health based on resident bug populations. An assessment of the bug population in any stream will give an indication of the health of that stream. In addition, they are an important part of the food web and their decline indicates a potential decline of other species.

The Benthic-invertebrate Index of Biological Integrity (BIBI) developed for Pacific Northwest streams was used to assess stream health from bug samples collected by volunteers. Figure 5 shows the overall BIBI scores from 2002 to 2004. Bug scores were typically low for the river, increasing from the 'Poor' category to the 'Fair' category from 2002 to 2003. Measurements of community diversity show a low number of pollution (heat and sediment) sensitive species and predators. However, the number of pollution tolerant species decreased each year, indicating that the conditions were able to support species other than only those very tolerant to pollution. Also, the number of mayfly species, which are very sensitive to pollution, increased each year of monitoring.

While there was some improvement some individual measures of the bug community, the site still had a moderate level of biological health, which is important considering the high water quality scores noted previously. Biological health in that stretch of river may be limited by habitat quality rather than by water quality. At another monitoring station located five miles upstream on the Little Washougal River, county staff observed a BIBI score of 42, in the upper 'Good' category, in 2004. While part of the same subwatershed, habitat conditions at this sample station upstream are slightly different in terms of the steepness of the stream and its underlying geology. As will be discussed in the next section, volunteers observed bedrock and larger streambed material at the downstream station, which may limit the suitability of the stream for diverse bug colonization.

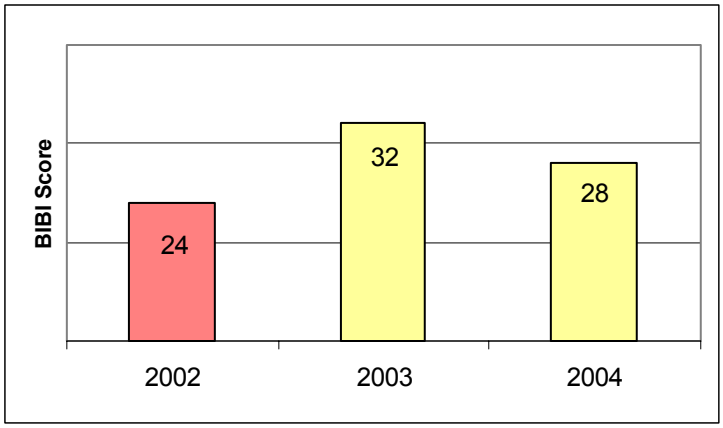

Figure 5. Pacific Northwest BIBI scores for Little Washougal River. Yellow bars indicate 'Fair' stream health and red bars indicate 'Poor' stream health.

Habitat Measures

Volunteers performed two habitat surveys during the summers of 2003 and 2004 at the Little Washougal River site. Their findings are summarized below:

- Reed Canary Grass and Himalayan Blackberry were non-native plants that were observed to be abundant along the creek; volunteers also noted the presence of Japanese Knotweed and referred the problem to the Clark County Weed Department.
- Gradient was measured to be slightly above 2% indicating a moderate slope to the stream's surface, although volunteers noted several steps or drops shaped by bedrock at the site.
- Substrate measurements in the form of pebble counts indicated that coarse gravel (marble to tennis ball sized) and cobble (tennis ball to basketball sized) each made up about 45% of the rocks on the stream bottom. Fine sediment accounted for between 3-4% of the substrate measured and very little filling-in with fine sediment was observed in the gravels.
- 80-90% of the stream surface near the banks was covered with tree and brush canopy according to readings in the summer. The middle of the river was more open, between 20-40% of the stream covered by tree canopy. The canopy cover was provided by a mix of deciduous and coniferous trees and volunteers noted several large fir trees on the left bank.
- Two large pools were identified near the ends of the reach that provided cover for aquatic life. Volunteers noted that both pools were formed by rock formations.
- Volunteers did not identify any areas of bank armoring or erosion.

Overall, the habitat measurements indicate a good setting for aquatic life in Little Washougal River. The presence of non-native plants and slightly impaired canopy cover indicate room for improvement, especially in light of high water temperatures observed during the summer.

The presence of bedrock throughout the reach provided good pool habitat for fish but also limited the amount of riffle area available for bug sampling. Riffles seemed to be perched on top of large chunks of bedrock, which may indicate a limitation of habitat available for bugs. Widely available riffles with varying rock sizes, and water depth and speed provide complex habitat for a variety of roles in the bug communities in terms of how they feed and where they live. Also, deep rock substrate on the stream bottom is often connected to ground water and the bugs can use this area as a place to hide from high flows or find cool water in the summer months. The riffles that the volunteers described may not provide good habitat for diverse bug communities and be a cause of lower-than-expected bug scores.

Management Issues

Currently, Little Washougal River is not on the WA State Department of Ecology's list of waterways requiring water quality cleanup plans. Data submitted to Ecology from Clark County's Volunteer Program may be used to list the Little Washougal River in the future for water temperature. Aside from the formal listing, the river's water quality in terms of water temperature and fecal coliform levels occasionally exceed state water quality standards. The majority of water quality limitations occur during low summer flows.

The occurrence of occasionally high fecal coliform levels could be investigated. Potential sources in the basin include road runoff during storms, direct stream access for stock watering, non-point source runoff from pastures, and contamination from poorly maintained septic systems. There are several homes in the river's floodplain that likely utilize septic systems. In addition there is a dairy in the lower reach of the river that may be a source of fecal coliform.

Management of the creek should include considerations for the identified water quality problems and low stream flows. Furthermore, as a tributary to the Washougal River, water quality in the creek should be supportive of overall management goals for salmon recovery in this very important fishery. Issues of warm water temperature and river flows have recently come to the forefront of resource management in the region. Local fish enhancement groups and agencies

working on the lower Washougal and Little Washougal Rivers will be notified of the results of this monitoring effort.

Future Monitoring

Future monitoring efforts in the river could include another brief period of monitoring in a few years to compare water quality trends to the data summarized in this report, focusing on parameters that influence salmon and trout populations. Clark County Water Resources staff will continue to operate the flow and water temperature gauge at the Blair Road crossing. Furthermore, a recent analysis of habitat, water temperature, and bug communities throughout the Little Washougal River subwatershed provides a detailed assessment of conditions for aquatic life and highlights potential projects to improve current conditions (Kalama, Washougal, and Lewis River Habitat Assessments: The Washougal River Basin, December 2004) The report is available from the Water Resources website at http://www.clark.wa.gov/water-resources/documents/Monitoring/LCFRB_Chapter6_WashougalBasin_FINAL_12.31.04.PDF.